

**SOLID ALKALINE FOAMING CLEANING COMPOSITIONS
WITH ENCAPSULATED BLEACHES**

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Cross Reference to Related Application

This application claims priority to United States Provisional Patent Application Serial No. 60/431,585 filed December 5, 2002, the entire disclosure of which is incorporated herein by reference.

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Field of the Invention

The present invention relates to a solid alkaline cleaning composition including encapsulated bleach and suitable for cleaning under conditions in which a high foaming cleaner is desirable.

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Background of the Invention

Conventional alkaline cleaners do not both bleach and foam. Liquid chlorinated cleaners usually do not include foaming surfactants because of their reactivity with the chlorine. In solids, surfactants are typically selected to maintain stability in the solid and in use solutions. In many instances, encapsulated bleaches are not sufficiently stable in solid alkaline cleaning compositions. Further, existing solid alkaline cleaners are typically low or non foaming. Typical foaming solids are incompatible with bleaches, particularly encapsulated bleaches. There remains a need for a foaming solid alkaline cleaner containing encapsulated bleach.

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Summary of the Invention

The present invention relates to a solid alkaline cleaning composition including encapsulated bleach and suitable for cleaning under conditions in which a high foaming cleaner is desirable. In an embodiment, the present solid alkaline cleaning composition includes source of alkalinity, sequestrant, foaming surfactant blend, encapsulated bleach. The foaming surfactant blend can include nonionic (e.g., amphoteric) and anionic surfactant,

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in proportions selected to provide desired foaming and dissolution of the encapsulated bleach.

Detailed Description of the Invention

5 Definitions

As used herein, a solid cleaning composition refers to a cleaning composition in the form of a solid such as a powder, a flake, a granule, a pellet, a tablet, a lozenge, a puck, a briquette, a brick, a solid block, a unit dose, or another solid form known to those of skill in the art.

10 Amounts of ingredients stated in this patent application generally refer to the amount of the particular active ingredient (e.g., nonionic surfactant). Amounts stated for commercial products typically relate to the amount of the commercial product. The amount of active provided by the commercial product can be determined from the concentration of the commercial product and the fraction of the commercial product that is the active ingredient.

15 As used herein, the term "about" modifying the quantity of an ingredient in the compositions of the invention or employed in the methods of the invention refers to variation in the numerical quantity that can occur, for example, through typical measuring and liquid handling procedures used for making concentrates or use compositions in the real world; through inadvertent error in these procedures; through differences in the manufacture, source, 20 or purity of the ingredients employed to make the compositions or carry out the methods; and the like. Whether or not modified by the term "about", it is intended that the claims include equivalents to the quantities.

Solid, Alkaline, Foaming Cleaning Compositions Containing Encapsulated Bleach

25 The present invention relates to solid, alkaline, foaming cleaning compositions that contain an encapsulated bleach. The present solid, alkaline, foaming cleaning compositions include a surfactant mixture that produces advantageous levels of foaming for hard surface cleaning, for example, in food processing environments. The advantageous foaming is achieved with an inventive combination of surfactants.

30 The present solid, alkaline, foaming cleaning compositions can contain as a source of alkalinity hydroxide salt, carbonate salt, bicarbonate salt, borate salt, amine, mixtures thereof,

and the like. For example, the present solid, alkaline, foaming cleaning composition can contain sodium hydroxide, potassium hydroxide, sodium carbonate (e.g., E form solid), potassium carbonate, mixtures thereof, and the like as a source of alkalinity. The present surfactant blend provides foaming with these sources of alkalinity.

5 In an embodiment, the present surfactant blend can also contribute to stability and dissolution of the encapsulated bleach in the composition. The encapsulated bleach particles can be dispersed throughout the solid, alkaline, foaming cleaning composition. Accordingly, the present bleaches can provide higher levels of encapsulated halogen bleach in standard highly caustic systems than conventional alkaline cleaners. Although not limiting to the
10 present invention, it is believed that the present surfactant blend may tie up water during processing, thus protecting the encapsulated bleach. In certain embodiments, the present compositions can provide one or more of advantageous foaming, advantageous cleaning, advantageous stability of chlorine in the use composition, and advantageous clarity of the intermediate and/or use solution. The present cleaning compositions can be dissolved in
15 water at a level of up to about 20 wt-% or up to about 15 wt.

The present foaming surfactant blends can be employed in any of a variety of known alkaline cleaning compositions. In particular, the present surfactant blends can be employed in the cleaning compositions disclosed in U.S. Patent Nos. 4,681,914, 4,569,781, RE32,818, 6,150,324, 6,156,715, 6,177,392, and 6,258,765, the disclosures of which are incorporated
20 herein by reference.

In addition, the present surfactant blend can be employed in an inventive solid, alkaline, foaming cleaning composition. The present alkaline cleaning composition can include alkalinity source, builder and/or water conditioning agent, surfactant blend, encapsulated bleach, and water. The present alkaline cleaning composition can include
25 alkalinity source, builder and/or water conditioning agent, surfactant blend, solidification agent, encapsulated bleach, and water. The present cleaning composition can be high foaming. The present cleaning composition can include, for example, the following components.

Surfactant

The present solid, alkaline, foaming cleaning composition can include a surfactant or surfactant blend. A variety of surfactants can be used in the present solid cleaning composition, including anionic, nonionic, amphoteric, cationic, and zwitterionic surfactants, which are commercially available. Anionic and nonionic surfactants are employed in certain embodiments. For a discussion of surfactants, see Kirk-Othmer, Encyclopedia of Chemical Technology, Third Edition, volume 8, pages 900-912.

In an embodiment, the present solid composition can include surfactant at about 1 to about 50 wt-%, about 2 to about 30 wt-%, or about 5 to about 20 wt-%. In an embodiment, the present solid composition includes surfactant at about 10 (e.g., 9) wt-%. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes surfactant in an amount effective to provide a desired level of cleaning and foaming.

In an embodiment, the present solid composition includes about 0.1 to about 3 wt-% nonionic surfactant and about 1 to about 40 wt-% anionic surfactant, about 0.2 to about 2 wt-% nonionic surfactant and about 2 to about 20 wt-% anionic surfactant, or about 0.3 to about 1 wt-% nonionic surfactant and about 5 to about 15 wt-% anionic surfactant. In an embodiment, the present solid composition includes nonionic surfactant at about 0.5 (e.g., 0.6) wt-% and anionic surfactant at about 8 wt-%. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes surfactant in an amount effective to provide a desired level of cleaning and foaming.

In an embodiment, the present solid cleaning composition includes nonionic surfactant (e.g., amine oxide surfactant) and anionic surfactant (e.g., alkyl or alkylaryl carboxylate, sulfate or sulfonate surfactant) in particular relative amounts. For example, the foaming surfactant blend can include 0.5 to 2 parts by weight nonionic and 1 to 20 parts by weight anionic surfactant. For example, the foaming surfactant blend can include 1 part by weight nonionic and 10-15 parts by weight anionic surfactant, 1 part by weight nonionic and 13 parts by weight anionic surfactant, or 1 part by weight nonionic and 14 parts by weight anionic surfactant. For example, the foaming surfactant blend can include 0.5-3 parts amine oxide surfactant, optionally 0.5-2 parts alkylcarboxylate surfactant, 1-6 parts sulfate surfactant, and 1-6 parts sulfonate surfactant. For example, the foaming surfactant blend can

include 2 parts by weight amine oxide surfactant, 1 part by weight alkylcarboxylate surfactant, 3 parts by weight sulfate surfactant, and 3 parts by weight sulfonate surfactant. For example, the foaming surfactant blend can include about 0.5 (e.g., 0.6) parts by weight amine oxide surfactant, 4 parts by weight sulfate surfactant, and 4 parts by weight sulfonate surfactant.

Nonionic Surfactant

Nonionic surfactants useful in the present solid cleaning compositions, include those having a polyalkylene oxide polymer as a portion of the surfactant molecule. These surfactants can be capped or uncapped. Such nonionic surfactants include, for example, chlorine-, benzyl-, methyl-, ethyl-, propyl-, butyl- and other like alkyl-capped polyethylene glycol ethers of fatty alcohols; polyalkylene oxide free nonionics such as alkyl polyglycosides; sorbitan and sucrose esters and their ethoxylates; alkoxyated ethylene diamine; alcohol alkoxyates such as alcohol ethoxylate propoxylates, alcohol propoxylates, alcohol propoxylate ethoxylate propoxylates, alcohol ethoxylate butoxylates, fatty alcohol ethoxylates (e.g., tridecyl alcohol alkoxyate, ethylene oxide adduct), and the like; nonylphenol ethoxylate, polyoxyethylene glycol ethers, and the like; carboxylic acid esters such as glycerol esters, polyoxyethylene esters, ethoxylated and glycol esters of fatty acids, and the like; carboxylic amides such as diethanolamine condensates, monoalkanolamine condensates, polyoxyethylene fatty acid amides, and the like; and polyalkylene oxide block copolymers including an ethylene oxide/propylene oxide block copolymer such as those commercially available under the trademark PLURONIC (BASF-Wyandotte), and the like; ethoxylated amines and ether amines commercially available from Tomah Corporation and other like nonionic compounds. Silicone surfactants such as the ABIL B8852 (Goldschmidt) can also be used.

Suitable nonionic surfactants include alkyl phenol ethoxylates, linear and secondary alcohol ethoxylates (fatty alcohol ethoxylates, e.g., tridecyl alcohol alkoxyate, ethylene oxide adduct), ethoxy/propoxy block surfactants, and polyether siloxanes. Examples of suitable nonionic surfactants include EO/PO block nonionic surfactant terminated in PO, silicone nonionic surfactant, benzyl ether of a polyethoxylated primary alcohol, nonylphenol ethoxylate (e.g., nonylphenol 9.5 mole ethoxylate), amine oxides, and the like.

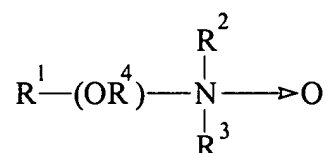
In an embodiment, the present solid composition includes nonionic surfactant at about 1 to about 50 wt-%, about 2 to about 30 wt-%, or about 5 to about 20 wt-%. In an embodiment, the present solid composition includes nonionic surfactant at about 10 wt-%. In an embodiment, the present solid composition includes about 0.1 to about 3 wt-% nonionic surfactant, about 0.2 to about 2 wt-% nonionic surfactant, or about 0.3 to about 1 wt-% nonionic surfactant. In an embodiment, the present solid composition includes nonionic surfactant at about 0.5 (e.g., 0.6) wt-%. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes surfactant in an amount effective to provide a desired level of cleaning and foaming.

In an embodiment, the present solid cleaning composition includes nonionic surfactant as a particular proportion of the foaming surfactant blend. For example, the foaming surfactant blend can include 0.5 to 2 parts by weight nonionic surfactant in each 10 to 20 parts by weight of the blend. For example, the foaming surfactant blend can include 1 part by weight nonionic surfactant in each about 15 (e.g. 13-14) parts by weight of the blend.

Semi-Polar Nonionic Surfactant

The semi-polar type of nonionic surface active agents are another class of nonionic surfactant useful in compositions of the present invention. Generally, semi-polar nonionics are high foamers and foam stabilizers. Semi-polar nonionic surfactants include amine oxide surfactants, phosphine oxide surfactants, sulfoxide surfactants, and their alkoxyated derivatives.

Amine oxides are tertiary amine oxides corresponding to the general formula:

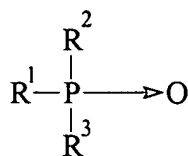


wherein the arrow is a conventional representation of a semi-polar bond; and, R^1 , R^2 , and R^3 may be aliphatic, aromatic, heterocyclic, alicyclic, or combinations thereof. Generally, for amine oxides of detergent interest, R^1 is an alkyl radical of from about 8 to about 24 carbon atoms; R^2 and R^3 are alkyl or hydroxyalkyl of 1-3 carbon atoms or a mixture thereof; R^2 and R^3 can be attached to each other, e.g. through an oxygen or nitrogen atom, to form a ring

structure; R⁴ is an alkaline or a hydroxyalkylene group containing 2 to 3 carbon atoms; and n ranges from 0 to about 20.

Useful water soluble amine oxide surfactants are selected from the coconut or tallow alkyl di-(lower alkyl) amine oxides, specific examples of which are dodecyldimethylamine oxide, tridecyldimethylamine oxide, etradeceyldimethylamine oxide, pentadecyldimethylamine oxide, hexadecyldimethylamine oxide, heptadecyldimethylamine oxide, octadecyldimethylamine oxide, dodecyldipropylamine oxide, tetradecyldipropylamine oxide, hexadecyldipropylamine oxide, tetradecyldibutylamine oxide, octadecyldibutylamine oxide, bis(2-hydroxyethyl)dodecylamine oxide, bis(2-hydroxyethyl)-3-dodecoxy-1-hydroxypropylamine oxide, dimethyl-(2-hydroxydodecyl)amine oxide, 3,6,9-trioctadecyldimethylamine oxide, 3-dodecoxy-2-hydroxypropyl-di-(2-hydroxyethyl)amine oxide, isoalkyl dimethyl amine oxide, stearyl dimethyl amine oxide, and octyl dimethyl amine oxide.

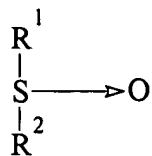
Useful semi-polar nonionic surfactants also include the water soluble phosphine oxides having the following structure:



wherein the arrow is a conventional representation of a semi-polar bond; and, R¹ is an alkyl, alkenyl or hydroxyalkyl moiety ranging from 10 to about 24 carbon atoms in chain length; and, R² and R³ are each alkyl moieties separately selected from alkyl or hydroxyalkyl groups containing 1 to 3 carbon atoms.

Examples of useful phosphine oxides include dimethyldecylphosphine oxide, dimethyltetradecylphosphine oxide, methylethyltetradecylphosphine oxide, dimethylhexadecylphosphine oxide, diethyl-2-hydroxyoctyldecylphosphine oxide, bis(2-hydroxyethyl)dodecylphosphine oxide, and bis(hydroxymethyl)tetradecylphosphine oxide.

Semi-polar nonionic surfactants useful herein also include the water soluble sulfoxide compounds which have the structure:



wherein the arrow is a conventional representation of a semi-polar bond; and, R¹ is an alkyl or hydroxyalkyl moiety of about 8 to about 28 carbon atoms, from 0 to about 5 ether linkages and from 0 to about 2 hydroxyl substituents; and R² is an alkyl moiety consisting of alkyl and hydroxyalkyl groups having 1 to 3 carbon atoms.

Useful examples of these sulfoxides include dodecyl methyl sulfoxide; 3-hydroxy tridecyl methyl sulfoxide; 3-methoxy tridecyl methyl sulfoxide; and 3-hydroxy-4-dodecoxybutyl methyl sulfoxide.

Suitable semi-polar nonionic surfactants for the compositions of the invention include dimethyl amine oxides, such as decyl dimethyl amine oxide, lauryl dimethyl amine oxide, myristyl dimethyl amine oxide, cetyl dimethyl amine oxide, combinations thereof, and the like.

In an embodiment, the present solid composition includes amine oxide surfactant at about 1 to about 50 wt-%, about 2 to about 30 wt-%, or about 5 to about 20 wt-%. In an embodiment, the present solid composition includes amine oxide surfactant at about 10 wt-%. In an embodiment, the present solid composition includes about 0.1 to about 3 wt-% amine oxide surfactant, about 0.2 to about 2 wt-% amine oxide surfactant, or about 0.3 to about 1 wt-% amine oxide surfactant. In an embodiment, the present solid composition includes amine oxide surfactant at about 0.5 (e.g., 0.6) wt-%. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes surfactant in an amount effective to provide a desired level of cleaning and foaming.

In an embodiment, the present solid cleaning composition includes amine oxide surfactant as a particular proportion of the foaming surfactant blend. For example, the foaming surfactant blend can include 0.5 to 2 parts by weight amine oxide surfactant in each 10 to 20 parts by weight of the blend. For example, the foaming surfactant blend can include 1 part by weight amine oxide surfactant in each 10-15 parts by weight of the blend.

Anionic Surfactant

Anionic surfactants useful in the present solid cleaning compositions, include, for example, carboxylates such as alkylcarboxylates (carboxylic acid salts) and polyalkoxycarboxylates, alcohol ethoxylate carboxylates, nonylphenol ethoxylate carboxylates, and the like; sulfonates such as alkylsulfonates, alkylbenzenesulfonates (e.g., linear dodecyl benzene sulfonic acid or salts thereof), alkylarylsulfonates, sulfonated fatty acid esters, and the like; sulfates such as sulfated alcohols, sulfated alcohol ethoxylates, sulfated alkylphenols, alkylsulfates, sulfosuccinates, alkylether sulfates, and the like; and phosphate esters such as alkylphosphate esters, ethoxylated alcohol phosphate esters, and the like. Suitable anionics include sodium alkylarylsulfonate, alkylbenzenesulfonates (e.g., linear dodecyl benzene sulfonic acid or salts thereof), sodium alkyl sulfate (e.g., sodium lauryl sulfate), ethoxylated alcohol phosphate esters, alpha-olefin sulfonate, carboxylates such as alkylcarboxylates (carboxylic acid salts), and fatty alcohol sulfates. Suitable alkylcarboxylates include those with 6 to 16 carbons, 8 to 16 carbons, 7 to 11 carbons, e.g., 8, 9, 10, 11, or 12 carbons. In an embodiment, the alkylcarboxylate includes isononanoic acid.

In an embodiment, the present solid composition includes anionic surfactant at about 1 to about 50 wt-%, about 2 to about 30 wt-%, or about 5 to about 20 wt-%. In an embodiment, the present solid composition includes anionic surfactant at about 10 wt-%. In an embodiment, the present solid composition includes about 1 to about 40 wt-% anionic surfactant, about 2 to about 20 wt-% anionic surfactant, or about 5 to about 15 wt-% anionic surfactant. In an embodiment, the present solid composition includes anionic surfactant at about 8 wt-%. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes surfactant in an amount effective to provide a desired level of cleaning and foaming.

In an embodiment, the present solid cleaning composition includes anionic surfactant as a particular proportion of the foaming surfactant blend. For example, the foaming surfactant blend can include 1 to 16 parts by weight anionic surfactant in each 1.5 to 17 parts by weight of the blend. For example, the foaming surfactant blend can include 16 parts by weight anionic surfactant in each 17 parts by weight of the blend.

Source of Alkalinity

The present solid, alkaline, foaming cleaning composition can include effective amounts of one or more inorganic detergents or alkalinity sources to enhance cleaning of a substrate and improve soil removal performance of the composition. The source of alkalinity can include an alkali metal salt, such as alkali metal carbonate, alkali metal hydroxide, alkali metal silicate (e.g., metasilicate), or the like; metal borate, such as sodium or potassium borate, and the like; ethanolamines and amines; inorganic alkalinity source, such as alkali metal hydroxide or silicate (e.g., metasilicate), or the like; and other like alkaline sources. In an embodiment, the quantity of alkalinity source is sufficient to render the composition strongly alkaline. In an embodiment the source of alkalinity includes sodium hydroxide, metal borate, alkali metal silicate, amine, or mixture thereof.

Suitable alkali metal hydroxides include, for example, sodium or potassium hydroxide, in an embodiment sodium hydroxide. An alkali metal hydroxide may be added to the composition in a variety of forms, including for example in the form of solid beads, dissolved in an aqueous solution, or a combination thereof. Alkali metal hydroxides are commercially available as a solid in the form of prilled solids or beads having a mix of particle sizes ranging from about 12-100 U.S. mesh, or as an aqueous solution, as for example, as a 50 wt-% and a 73 wt-% solution.

Examples of useful alkaline metal silicates include sodium or potassium silicate (with a $M_2O:SiO_2$ ratio of 1:2.4 to 5:1, M representing an alkali metal) or metasilicate. Suitable alkaline metal silicates include sodium metasilicate.

In an embodiment, the present solid cleaning composition includes about 20 to about 70 wt-%, about 25 to about 60 wt-%, or about 30 to about 50 wt-% source of alkalinity. In an embodiment, the present solid cleaning composition can include about 40 wt-% source of alkalinity. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes source of alkalinity in an amount effective to provide a desired level of cleaning.

Sequestrant/Builder

The present solid, alkaline, foaming cleaning composition can include sequestrant or builder. In general, a sequestrant is a molecule capable of coordinating (i.e., binding) the

metal ions commonly found in natural water to prevent the metal ions from interfering with the action of the other deterative ingredients of a cleaning composition. Some chelating/sequestering agents can also function as a threshold agent when included in an effective amount. For a further discussion of chelating agents/sequestrants, see Kirk-Othmer,
5 Encyclopedia of Chemical Technology, Third Edition, volume 5, pages 339-366 and volume 23, pages 319-320.

A variety of sequestrants or builders can be used in the present solid cleaning composition, including, for example, organic phosphonate, aminocarboxylic acid, condensed phosphate, inorganic builder, polymeric polycarboxylate, mixture thereof, or the like. Such
10 sequestrants and builders are commercially available. In an embodiment, the present solid cleaning composition includes about 5 to about 60 wt-%, about 5 to about 40 wt-%, or about 30 to about 50 wt-% sequesterant or builder. In an embodiment, the present solid cleaning composition can include about 10 (e.g., 9) wt-%. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition
15 includes sequesterant or builder in an amount effective to provide a desired level of cleaning.

Polycarboxylates suitable for use as cleaning agents include, for example, polyacrylic acid, maleic/olefin copolymer, acrylic/maleic copolymer, polymethacrylic acid, acrylic acid-methacrylic acid copolymers, hydrolyzed polyacrylamide, hydrolyzed
20 polymethacrylamide, hydrolyzed polyamide-methacrylamide copolymers, hydrolyzed polyacrylonitrile, hydrolyzed polymethacrylonitrile, hydrolyzed acrylonitrile-methacrylonitrile copolymers, polymaleic acid, polyfumaric acid, copolymers of acrylic and itaconic acid, phosphino polycarboxylate, and the like. Suitable polycarboxylates include polyacrylate.

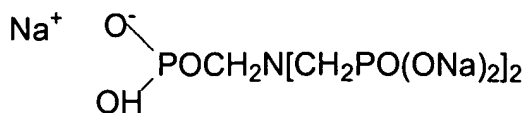
In an embodiment, the present solid cleaning composition includes about 1 to about
25 40 wt-%, about 2 to about 30 wt-%, or about 5 to about 15 wt-% polycarboxylate. In an embodiment, the present solid cleaning composition can include about 7 wt-% polycarboxylate. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes polycarboxylate in an amount effective to provide a desired level of cleaning.

30 The builder can include an organic phosphonate, such as an organic-phosphonic acid and alkali metal salts thereof. Some examples of suitable organic phosphonates include:

1-hydroxyethane-1,1-diphosphonic acid: $\text{CH}_3\text{C}(\text{OH})[\text{PO}(\text{OH})_2]_2$;

aminotri(methylenephosphonic acid): $\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_3$;

aminotri(methylenephosphonate), sodium salt



5 2-hydroxyethyliminobis(methylenephosphonic acid): $\text{HOCH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2$;

diethylenetriaminepenta(methylenephosphonic acid):

$(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2]_2$;

2-phosphonobutane-1, 2, 4-tricarboxylic acid;

diethylenetriaminepenta(methylenephosphonate), sodium salt: $\text{C}_9\text{H}_{(28-x)}\text{N}_3\text{Na}_x\text{O}_{15}\text{P}_5$ ($x=7$);

10 hexamethylenediamine(tetramethylenephosphonate), potassium salt: $\text{C}_{10}\text{H}_{(28-x)}\text{N}_2\text{K}_x\text{O}_{12}\text{P}_4$ ($x=6$);

bis(hexamethylene)triamine(pentamethylenephosphonic acid):

$(\text{HO})_2\text{POCH}_2\text{N}[(\text{CH}_2)_6\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2]_2$; and

phosphorus acid H_3PO_3 ; and other similar organic phosphonates, and mixtures thereof.

15 Suitable organic phosphonates include PBTC.

In an embodiment, the present solid cleaning composition includes about 0.1 to about 20 wt-%, about 0.5 to about 10 wt-%, or about 1 to about 5 wt-% phosphonate. In an embodiment, the present solid cleaning composition can include about 2 wt-% phosphonate. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes phosphonate in an amount effective to provide a desired level of cleaning.

The sequestrant can be or include aminocarboxylic acid type sequestrant. Suitable aminocarboxylic acid type sequestrants include the acids or alkali metal salts thereof, e.g., amino acetates and salts thereof. Some examples include the following:

25 N-hydroxyethylaminodiacetic acid;

hydroxyethylenediaminetetraacetic acid, nitrilotriacetic acid (NTA);

ethylenediaminetetraacetic acid (EDTA);

N-hydroxyethyl-ethylenediaminetriacetic acid (HEDTA);

diethylenetriaminepentaacetic acid (DTPA); and

30 alanine-N,N-diacetic acid;

and the like; and mixtures thereof.

Suitable aminocarboxylates include ethylenediamine tetraacetic acid (EDTA), diethylenetriamine pentaacetic acid (DTPA), their alkali metal salts, and mixtures thereof. Suitable aminocarboxylates include the sodium salt of EDTA.

5 Suitable condensed phosphates include sodium and potassium orthophosphate, sodium and potassium pyrophosphate, sodium and potassium tripolyphosphate, sodium hexametaphosphate, and the like, e.g., the sodium salt, e.g., of pyrophosphate. A condensed phosphate may also assist, to a limited extent, in solidification of the composition by fixing the free water present in the composition as water of hydration. In an embodiment, the present solid cleaning composition includes as a builder, chelator, or sequestrant a condensed phosphate, such as tetrasodium pyrophosphate.

 In an embodiment, the present solid cleaning composition includes as sequestrant or builder condensed polyacrylate and phosphonate, for example, sodium polyacrylate and 2-phosphonobutane-1, 2, 4-tricarboxylic acid (PBTC, sold under the tradename Bayhibit AM).

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Solidification Agent

 The solidification agent in the present cleaning compositions participates in maintaining the compositions in a solid form. Although other components of the solid composition may also be solids, the solidification agent can maintain the overall composition including solid and liquid components in a solid form. In an embodiment, the solidification agent can assist the source of alkalinity in maintaining the solid cleaning composition in solid form.

 Suitable solidification agents include a solid polyethylene glycol (PEG), a solid EO/PO block copolymer, and the like; an amide, such as stearic monoethanolamide, lauric diethanolamide, an alkylamide, or the like; starches that have been made water-soluble through an acid or alkaline treatment process; celluloses that have been made water-soluble; an inorganic agent, such as, sodium hydroxide (e.g., caustic hydrate), a carbonate-based solidification agent (e.g. an E-form or sodium carbonate), sodium acetate, sodium sulfate, alkali metal phosphates (e.g., STPP, TKPP, and TSPP), silicates, such as sodium silicate and sodium metasilicate, or the like; poly(maleic anhydride/methyl vinyl ether); polymethacrylic acid; other generally functional or inert materials with high melting points; various

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inorganics that impart solidifying properties to a heated composition upon cooling; and the like.

In certain embodiments, the solidification agent includes solid PEG, for example PEG 1500 up to PEG 20,000. In certain embodiments, the PEG includes PEG 1450, PEG 3350, 5 PEG 4500, PEG 8000, PEG 20,000, and the like. Additional suitable solidification agents include EO/PO block copolymers such as those sold under the tradenames Pluronic 108, Pluronic F68; amides such as lauric diethanolamide or cocodiethylene amide; and the like. In certain embodiments, the solidification agent includes a combination of solidification agents, such as combination of PEG and an EO/PO block copolymer (such as a Pluronic) and 10 combination of PEG and an amide (such as lauric diethanol amide or stearic monoethanol amide).

In an embodiment, for more controlled dispensing, the solidification agent is not an extremely water soluble solid, such as urea. In this embodiment, other disfavored solidification agents include other hygroscopic solids.

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Encapsulated Bleach

The present high foaming, solid, alkaline cleaning compositions can include any of a variety of known encapsulated bleaches. Suitable encapsulated bleaches are described in, for example, U.S. Patent Nos. 4,657,784, 4,681,914, 4,731,195, 4,830,773, 4,933,102, 20 5,213,705, 5,358,653, and 6,589,443, the disclosures of which are incorporated herein by reference.

Suitable encapsulated bleaches include those with a core of an active halogen compound and at least one outer coating layer. The outer coating can include a halogen and alkaline compatible material, such as a halogen and alkaline compatible surfactant or 25 detergent (e.g. an alkylcarboxylate, an n-alkylsulfonate, a water soluble cellulose, or an alkylphosphate ester). In an embodiment, the encapsulated bleach includes two coating layers, with an inner inorganic layer. The inner inorganic layer can include, for example, sodium sulfate and/or sodium tripolyphosphate. In an embodiment, the present coatings can provide advantageous dissolution of the encapsulated bleach in an alkaline, even caustic, 30 cleaning composition. In an embodiment, the present coatings can provide advantageous

protection of the encapsulated bleach during processing of an alkaline, even caustic, cleaning composition. This can occur in conjunction with the surfactant blend.

In an embodiment, the present solid cleaning composition includes about 0.2 to about 70 wt-%, about 10 to about 50 wt-%, or about 20 to about 40 wt-% encapsulated bleach. In an embodiment, the present solid cleaning composition includes about 30 (e.g., 32) wt-% encapsulated bleach. The composition can include any of these ranges or amounts not modified by about. In an embodiment, the cleaning composition includes encapsulated bleach in an amount effective to provide a desired level of brightening or whitening.

10 **High Foaming, Solid, Alkaline Cleaning Compositions Containing Encapsulated Bleach**

Some examples of representative constituent concentrations for the present solid cleaning compositions can be found in Table 2, in which the values are given in wt-% of the ingredients in reference to the total composition weight. In certain embodiments, the proportions and amounts in Table 1 can be modified by “about”.

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Table A. Compositional Ranges for High Foaming, Solid, Alkaline Cleaning Compositions Containing Encapsulated Bleach

Class of Ingredient	The Class Includes:	Wt-%	Wt-%	Wt-%	Wt-%
Alkalinity Source	NaOH, KOH	20-70	25-60	30-50	40
Sequestrant/Builder	Polyacrylates, Triphosphates, Polymers	5-60	5-40	8-20	10
Surfactant	Nonionic and anionic surfactants	1-50	2-30	5-20	10
Encapsulated Bleaching Agent		0.2-70	10-50	20-40	30
Water		5-20	7-17	8-12	10

Some suitable concentrations of representative constituents for the present solid cleaning compositions can be found in Table 3, in which the values are given in wt-% of the ingredients in reference to the total composition weight. In certain embodiments, the proportions and amounts in Table 1 can be modified by “about”.

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Table B. Compositional Ranges for High Foaming, Solid, Alkaline Cleaning Compositions Containing Encapsulated Bleach

Class of Ingredient	The Class Includes:	Wt-%	Wt-%	Wt-%	Wt-%
Alkalinity Source	NaOH, KOH	20-70	25-60	30-50	40
Sequestrant/Builder	Polyacrylate	1-40	2-30	5-15	7
	Phosphonate	0.1-20	0.5-10	1-5	2
Surfactant	Nonionic	0.1-3	0.2-2	0.3-1	0.6
	Anionic	1-40	2-20	5-15	8
Encapsulated Bleaching Agent		0.2-70	10-50	20-40	30
Water		5-20	7-17	8-12	10

Solid, Alkaline, Foaming Cleaning Compositions Without Bleach

5 In an embodiment, the present invention relates to solid, alkaline, foaming cleaning compositions as described above, but without the encapsulated bleach. This embodiment of the present solid, alkaline, foaming cleaning compositions also includes the surfactant mixture that produces advantageous levels of foaming for hard surface cleaning, for example, in vehicle washing. The compositions lacking bleach include the relative concentrations of ingredients stated above. The absolute concentrations for the compositions lacking bleach can be obtained by substituting parts for wt-% above or by correcting the wt-% above for the absence of encapsulated bleach.

Additives

15 Solid cleaning compositions according to the invention can also include additional functional materials or additives that provide a beneficial property, for example, to the composition in solid form or when dispersed or dissolved in an aqueous solution, e.g., for a particular use. Examples of conventional additives include one or more of each of salt or additional salt, deterative polymer, cleaning agent, rinse aid composition, softener, pH modifier, source of acidity, anti-corrosion agent, solubility modifier, detergent filler, anti-redeposition agent, antimicrobial, rinse aid composition, threshold agent or system, aesthetic enhancing agent (i.e., dye, odorant, perfume), optical brightener, lubricant composition, bleaching agent, enzyme, effervescent agent, other such additives or functional ingredients, and the like, and mixtures thereof.

Adjuvants and other additive ingredients will vary according to the type of composition being manufactured, and the intended end use of the composition. In an embodiment, the composition includes as an additive one or more of cleaning enzyme, detergent polymer, antimicrobial, or mixtures thereof.

5

Concentrate and Use Compositions

The solid cleaning composition according to the present invention can be suspended or dissolved in water to form a concentrate or intermediate composition. The present cleaning composition can be dissolved in water to form a use composition. For example, a
10 dispenser can spray the solid composition with water to form a concentrate, intermediate, or use composition. That composition can collect in a day tank. That composition can be delivered from the dispenser to the site of use. At the site of use, the concentrate or intermediate concentration can be diluted to form the use composition. Alternatively, the present solid cleaning composition can be added to or mixed with sufficient water to form a
15 use composition without forming a concentrate composition. For example, the solid cleaning composition can be diluted directly with water to form a use composition.

In an embodiment, the present solid cleaning composition can be dissolved to form a use composition that is used in a foamer. Foaming application can be accomplished, for example, using a foam application device such as a tank foamer or an aspirated wall mounted
20 foamer, e.g., employing a foamer nozzle of a trigger sprayer. Foaming application can be accomplished by placing the use composition in a fifteen gallon foam application pressure vessel, such as a fifteen gallon capacity stainless steel pressure vessel with mix propeller. The foaming composition can then be dispensed through a foaming trigger sprayer. A wall mounted foamer can use air to expel foam from a tank or line.

25 The concentrate composition can include about 1 to about 20 wt-%, about 2 to about 15 wt-%, or about 5-15 wt-% of the solid cleaning composition. The use composition can include about 0.01 to about 3 wt-%, about 0.1 to about 2.5 wt-%, about 0.3 to about 2 wt-%, about 0.05 to about 2 wt-%, or about 0.1 to about 1.5 wt-% of the solid cleaning composition.

Processing of the Composition

Any of a variety of known methods for casting, extruding, or otherwise processing solid cleaning compositions can be employed for processing the present composition. For example, a broad variety of mixing, forming, casting, molding, extruding, and other such techniques may be used to form the solid composition in accordance with other embodiments of the invention.

In an embodiment, a suitable solid cleaning composition can be formed, for example, by: (i) mixing the surfactant, source of alkalinity, and solidification agent; (ii) heating, if necessary, to form a melt; (iii) blending in additional solid ingredients, such as builder or secondary solidification agent (if present); (iv) adding encapsulated bleach; and (v) cooling the composition to form a solid cleaning composition. The composition can be cast into a receptacle before complete solidification. Solidification of the composition can be accomplished by any conventional manner, such as cooling under room conditions, spraying with cold water, quenching in a cooling tank, or cooling in a refrigerated unit.

In an embodiment the ingredients can be mixed and extruded. The present compositions can be extruded by, for example, mixing the ingredients or premixes in order, and dispensing the mixed composition, e.g., into a container or shrink wrap. The mixture can be discharged from the mixing system through a die or other shaping apparatus and cut to a desired length. Alternatively, the molten mixture can be extruded into a shaped container and allowed to solidify.

Mixing for extrusion can include continuous mixing of the ingredients at high shear to form a substantially homogeneous liquid or semi-solid mixture in which the ingredients are distributed throughout its mass. The mixing system can include means for mixing the ingredients to provide shear or heat effective for maintaining the mixture at a flowable consistency. The mixture can be processed at a temperature to maintain the physical and chemical stability of the ingredients. The mixture can be processed at a temperature to keep the ingredients sufficiently liquid to flow and solid enough to harden. An ingredient can be in the form of a liquid or a solid such as a dry particulate, and may be added to the mixture separately or as part of a premix with another ingredient. One or more premixes may be added to the mixture. The temperature of the mixture when discharged from the mixing

system can be sufficiently low to enable the mixture to be cast or extruded directly into shape that can be cut to the desired length without first cooling the mixture.

Packaging System

5 In some embodiments, the solid composition can be packaged. The packaging receptacle or container may be rigid or flexible, and composed of any material suitable for containing the compositions produced according to the invention, as for example glass, metal, plastic film or sheet, cardboard, cardboard composites, paper, and the like.

10 In an embodiment, the temperature of the processed mixture is low enough so that the mixture may be cast, molded or extruded directly into the container or other packaging system without structurally damaging the material. As a result, a wider variety of materials may be used to manufacture the container than those used for compositions that processed and dispensed under molten conditions.

15 In an embodiment, the packaging used to contain the compositions includes a rigid capsule.

Dispensing of the Processed Compositions

20 The cleaning composition made according to the present invention can be dispensed by any suitable method generally known. In an embodiment, the present solid cleaning composition is dissolved to form a use composition that is dispensed by foaming it onto the object to be cleaned. Foaming application can be accomplished by a foamer applicator. For example, a foamer can inject compressed air into a container of the dissolved composition, and apply it to the surface to be cleaned through a foam application device such as a tank foamer or an aspirated wall mounted foamer, e.g., employing a foamer nozzle of a trigger
25 sprayer.

30 The cleaning composition can be dispensed from a spray-type dispenser such as that disclosed in U.S. Patent Nos. 4,826,661, 4,690,305, 4,687,121, 4,426,362 and in U.S. Patent Nos. Re 32,763 and 32,818, the disclosures of which are incorporated by reference herein. Briefly, a spray-type dispenser functions by impinging a water spray upon an exposed surface of the solid composition to dissolve a portion of the composition, and then directing

the concentrate or use solution including the composition out of the dispenser to a storage reservoir or directly to a point of use.

In some embodiments, the compositions hereof will be formulated such that during use in aqueous cleaning operations the wash water will have a pH of between about 7 and about 14, e.g., between about 7 and about 11.

Methods Employing the Present Compositions

It is contemplated that the present alkaline solids containing encapsulated bleach can be used in a broad variety of institutional, food industry, household, vehicle care, and other such applications. Some examples include surface cleaner, vehicle cleaning, floor cleaning, surface cleaning, clean-in-place, ware washing, laundry, and a broad variety of other such applications. The present alkaline cleaning compositions can be employed for cleaning an article that would benefit from cleaning with a low or non-foaming, bleach-containing cleaner, for example, a solid, defoaming chlorinated alkaline cleaner.

The methods include making from the solid cleaning composition a concentrate and/or use composition, and applying the use composition to the article to be cleaned. In an embodiment, the use composition is foamed onto the article to be cleaned. In these methods, the present composition provides more and/or longer lasting foam than conventional foaming hard surface cleaning compositions.

The present invention may be better understood with reference to the following examples. These examples are intended to be representative of specific embodiments of the invention, and are not intended as limiting the scope of the invention.

EXAMPLES

Several examples of the present high foaming, solid, alkaline cleaning composition was made and included:

Table 1

Ingredient	Wt-%	Wt-%	Wt-%
Sodium hydroxide, 50% liquid	4.3	4.3	4.3
Sodium hydroxide, beads	37	37	37
Sodium polyacrylate, powder	7.2	7.2	7.2
Bayhibit AM, 50% (phosphonate)	3.6	3.6	3.6
Barlox 12, 30% (amine oxide surfactant)	5.2	2	9.6
Colatrop INC-K, 45% (alkylcarboxylate surfactant)	2.2	-	-
Sodium lauryl sulfate powder	2.9	4	2.9
LAS 90% flakes	3.2	4.5	3.2
Encapsulated bleach	32	32	32
Water, soft	2.9	5.4	0.2

This composition was made by mixing the ingredients other than the encapsulated bleach, cooling, adding the encapsulated bleach, and casting the composition into plastic capsules.

Table 2 shows data demonstrating that the solid cleaning compositions according to the present invention exhibited superior soil removal compared to a comparable liquid cleaning composition. The compositions were tested against laboratory food soil samples, red and yellow food soil. Yellow food soil includes beef stew, tomato sauce, margarine, and powdered milk. Red food soil includes lard, corn oil, egg, and iron. Each soil was placed on pieces of delrin material. The soiled delrin material was contacted with the cleaning composition for 5 minutes, and the material was dipped in a rinse. The weight of the soil on the material was determined before and after cleaning. The comparable liquid cleaning composition was employed at its recommended average medium duty amount (99 g/gal).

The present solid cleaning composition out performed the liquid at equal concentrations of actives (23 g/gal solid) and even at 75% of this concentration (19 g/gal).

Table 2 - Cleaning Performance of the Present Solid Cleaning Compositions

	Amount in Use Solution (gm/gal)	% Yellow Food Soil Removed	% Red Food Soil Removed
Comparable Liquid Cleaning Composition	99	62	50
Present Solid Cleaning Composition	23	73	69
Present Solid Cleaning Composition	17	67	69
Water		32	52

Table 3 shows data demonstrating that the solid cleaning compositions according to the present invention exhibited superior foaming compared to a comparable liquid cleaning composition. The compositions were sprayed onto a vertical stainless steel wall with a Foam-It dispenser. The compositions were at 120 °F. The use solution of the conventional liquid was sprayed at the mid-point setting of the dispenser. The use solutions of the present solid compositions were sprayed 2 turns toward wet from the mid-point setting of the dispenser.

10

Table 3 - Foaming Performance of the Present Solid Cleaning Compositions

	Amount in Use Solution (gm/gal)	Foam Thickness (in)	Foam Hang Time (sec)	Foam Remaining (%) at 2 min	Foam Rate of Vertical Travel
Comparable Liquid Cleaning Composition	99	0.06	64 (thin layer)	40 (uniform travel)	fast
Present Solid Cleaning Composition	23	1-1.5	48 (very thick)	25 (broken foam)	fast
Present Solid Cleaning Composition	17	0.5-1	63 (thick layer)	40 (broken foam)	slow to medium

The comparable liquid composition produced very wet looking foam regardless of the wet/dry setting on the dispenser. Most of the use composition ran quickly down the wall leaving only a thin layer of foam. Compared to the solid compositions, it had a strong irritating chlorine odor.

5 At 23 g/gal a use composition of the present solid composition produced foam so thick (like shaving cream) that the dispenser seemed to struggle with it. The foam was heavy, dense and very thick. It was fast moving and broke early.

 At 17 g/gal a use composition of the present solid composition produced nice thick dense foam with a tolerable chlorine odor. It exhibited good travel down the wall.

10

 It should be noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to a composition containing "a compound" includes a mixture of two or more compounds. It should also be noted that the term "or" is generally
15 employed in its sense including "and/or" unless the content clearly dictates otherwise.

 All publications and patent applications in this specification are indicative of the level of ordinary skill in the art to which this invention pertains.

 The invention has been described with reference to various specific and preferred embodiments and techniques. However, it should be understood that many variations and
20 modifications may be made while remaining within the spirit and scope of the invention.